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NASA TECH BRIEF

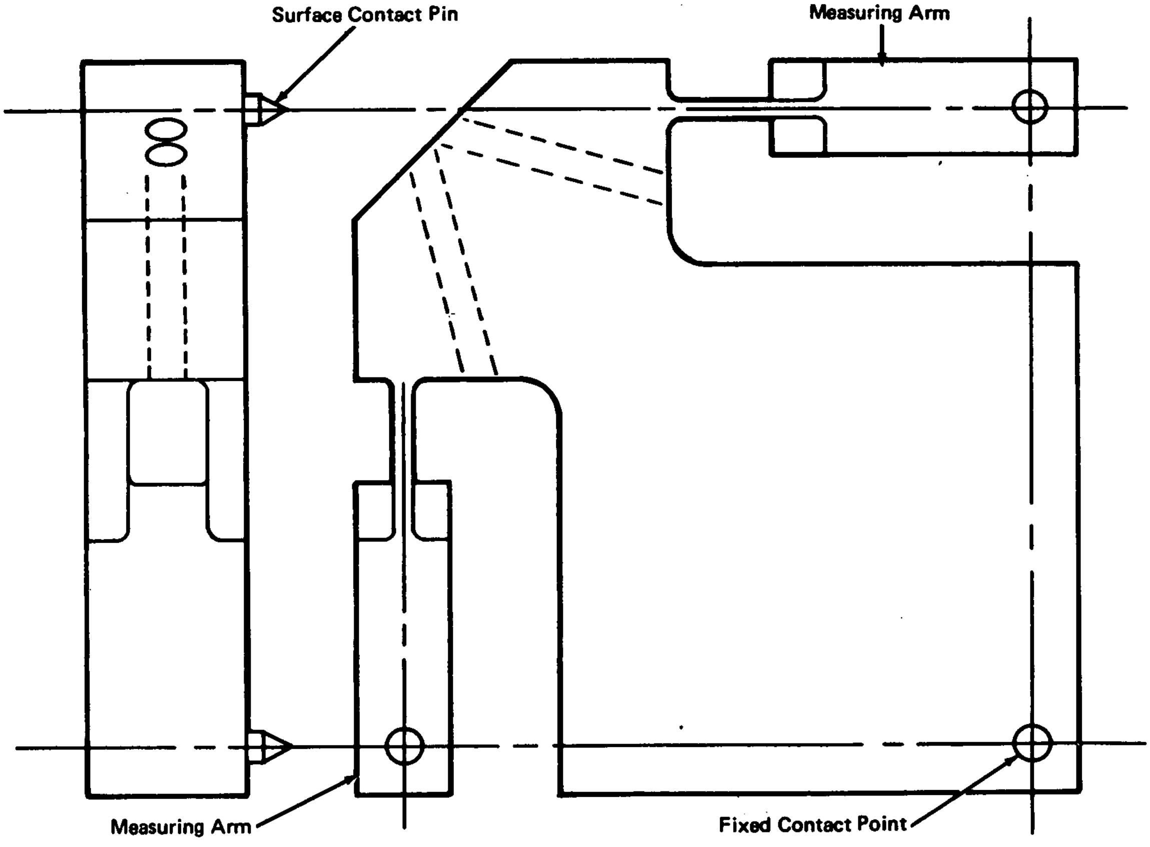
Langley Research Center

Miniature Biaxial Strain Transducer

The strain transducer illustrated permits biaxial strain measurements to be readily made to establish important mechanical property parameters of materials on a quick-look basis. It is completely reusable and permits relocation to alternate measurement points to be accomplished quickly. The miniature size of this device permits biaxial strain measurements to be made simultaneously over small areas and yields outputs directly proportional to the strains measured, thus eliminating the requirement for conversion computations.

This strain transducer is being used to verify elastic modulus, Poisson's ratio, and principal strain axes on materials. It is also used as a standard in checking experimental strain gauges. The design of this device can be modified to suit measurement needs, considering such things as strain measurement range, output sensitivity, gauge length, attachment means, and forces induced in measured material surfaces.

The mutually perpendicular centerlines which pass through the surface contact pins (see illustration) define



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(continued overleaf)

the axes, which in use are alined with the principal strain axes of the surface on which biaxial strain measurements are to be made. The device can be easily relocated to make any desired number of successive measurements where strain gradients are not severe and can be used to establish principal strain axes. It can be held in place by dead weights or by elastic bands, with elastic bands being preferred. One surface contact pin is rigidly held by the device, and biaxial strain measurements are made with reference to this fixed contact point. The two independent measuring arms are simple cantilever members which are designed to develop known stress levels in a designated measurement area when either one of the arms is deflected a known amount.

The fixed pin forms a measurement pair in combination with pins on each of the measurement arms, and deflections occur in the measurement arms whenever strain in the measured surface causes the spacings between the contact pins of a measurement pair to change. Strain gauges in conventional full Wheatstone bridge arrangement are installed on each measurement arm to sense its strain level in the designated measurement area, with the strain signal being directly proportional to the pin spacing of a measurement pair. Pin spacing versus strain gauge output calibrations must be made to establish this relationship accurately. Strain level in the sensing area is controlled through design to permit an almost unlimited number of measurement cycles to be made within the deflection measuring range of each arm. With the exception of the three surface contact pins and their retaining setscrews, the device is all one piece.

This general design concept lends itself to strain measurement levels of at least 5 percent, gauge lengths down to 1.25 centimeters, and total device weights in the 20- to 30-gram range. Activation forces also range from 20 to 30 grams. Uniaxial devices, with a single measuring arm, can also be designed in similar fashion, except that two rigid support pins will require simple flexure mounting for the transverse direction only, to accommodate unmeasured Poisson strains.

Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B74-10180

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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(LAR-11648)